Development of a single wave energy converter for the WECfarm project

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This work refers to PhD research performed at Ghent University, Belgium, within the topic: "Experimental study and numerical modelling of combined near-field interactions and far-field effects of wave energy converter farms". A new experimental campaign within the WECfarm project has been initiated to obtain a database to validate new advanced numerical models for WEC array modelling. At the time of the 3rd Online WECANet General Assembly (November 2020), dry-testing of the first WEC is occurring. The importance of dry-testing is to check the proper working of all mechanic, electronic and control aspects before deploying the WEC in a wave flume or wave basin. After wave basin testing and the corresponding performance evaluation, four additional WECs will be constructed. The WECfarm experiments with arrays of up to five WECs will be conducted at the Coastal and Ocean Basin (COB) [1] in Ostend in 2022, as part of the collaboration between Aalborg University, Denmark (dr. Francesco Ferri), Queen's University Belfast, UK (dr. Matt Folley) and The University of Edinburgh, UK (dr. David Forehand).

The working principle of the WEC is the one of a point absorber operating in heave. The hydrodynamic part of the design consists of a thermofolded truncated cylindrical buoy. The performance of the buoy is numerically evaluated in WEC-Sim. The mechanic part of the WEC design consists of a rack and pinion power take-off. A gearbox with ratio 1:4 connects the pinion with the Permanent-Magnet Synchronous Motor (PMSM). The motor torque-speed curves are obtained from a MATLAB Simulink Simscape Multibody model. A guiding system of three air bushings excludes friction effects in the power absorption measurements. The motor operates in torque control and is powered by a motor drive. The MATLAB Simulink control model is built on the development computer and loaded on a Speedgoat Performance real-time target machine. The input of the control model consists of the position, velocity, acceleration of the buoy and the vertical force on the buoy. These are obtained with a laser sensor, motor encoder, accelerometer and configuration of three loads cells, respectively. The output of the control model is the torque to deliver to the motor.

References

[1] Troch, P., Stratigaki, V., Devriese, P., Kortenhaus, A., De Maeyer, J., Monbaliu, J., Toorman, E., et al. (2018). Design features of the upcoming coastal and ocean basin in Ostend, Belgium. In P. Lynett (Ed.), Proceedings of 36th Conference on Coastal Engineering, Baltimore, Maryland, 2018. Presented at the 36th international Conference on Coastal Engineering, ICCE2018.

COST is supported by the EU Framework Programme Horizon 2020. COST (European Cooperation in Science and Technology) is a funding agency for research and innovation networks. COST Actions help connect research initiatives across Europe and enable scientists to grow their ideas by sharing them with their peers.

Acknowledgements

The first author, Timothy Vervaet, would like to acknowledge his PhD Aspirant Research Fellowship by the Research Foundation Flanders, Belgium (FWO) (application number 11A6919N). Funding for constructing the experimental set up has been awarded by an 'FWO Research Grant' application granted to dr. Vasiliki Stratigaki (Reference code FWO-KAN-DPA376). Vasiliki Stratigaki is a postdoctoral researcher (fellowship 1267321N) of the FWO (Fonds Wetenschappelijk Onderzoek - Research Foundation Flanders), Belgium.

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Online | November 26-27, 2020

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EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

ISBN: 9789080928107

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ISBN: 9789080928107

This publication is based upon work from the WECANet COST Action CA17105, supported by COST (European Cooperation in Science and Technology). Support is also provided by the FWO (Fonds Wetenschappelijk Onderzoek - Research Foundation Flanders), Belgium. Vasiliki Stratigaki is a postdoctoral researcher (fellowship 1267321N) of the FWO.

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Funded by the Horizon 2020 Framework Programme of the European Union